

Award Title: **Climate Adaptation Partnership for the Pacific (CAPP): Pacific RISA Phase II**

Performance Period: September 1, 2010 – April 30, 2011

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Current areas of focus:

1. Conduct place-based assessment of risk and vulnerabilities and develop adaptation strategies.
 - Especially as relevant to freshwater resource availability and sustainability.
2. Support the implementation of adaptation strategies for Pacific Island communities.
 - Via review, gap analysis, and update of the Hazard Mitigation Plans for Pacific Islands with respect to climate information.
3. Evaluate adaptation plans and policy making in the Pacific region.
 - Initially as relevant to the Hawai'i State Water Code.
4. Evaluate the Pacific RISA program
 - Develop working logic model, evaluation metrics, and project evaluation template.

Main stakeholders and partners:

The Pacific RISA works with a large network of local and regional partners, including: The Pacific Climate Information System (PaCIS); Pacific Islands Climate Change Cooperative (PICCC); NOAA's Pacific ENSO Applications Center (PEAC); National Weather Service (NWS), Pacific Region; USGS Pacific Islands Water Science Center; University of Guam, Water and Environmental Research Institute (WERI); Regional Climate Services Director, Pacific Region.

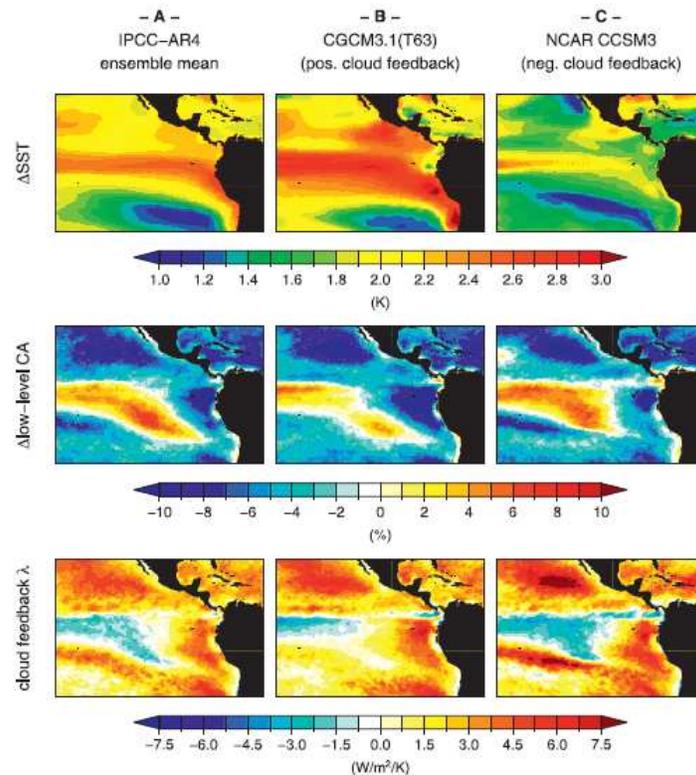
Our main stakeholders targeted at the federal level are the US Geological Survey (USGS); US Department of Agriculture (USDA); US Fish and Wildlife Service (USFWS); US Army Corps of Engineers (USACE); US Army Garrison Hawaii (USAG-HA); Natural Resources Conservation Service (NRCS); Environmental Protection Agency (EPA); US National Park Service (NPS); and the Federal Emergency Management Agency (FEMA) Region IX and Pacific Area office. Other stakeholders targeted include the Guam Emergency Management Office and American Samoa government officials in disaster management.

State stakeholders and agencies include Department of Land and Natural Resources (DLNR) Hawai'i Commission on Water Resource Management; the Department of Health, Clean Water Branch; Honolulu Board of Water Supply; County of Maui Department of Water Supply; Office of Planning; Department of Business, Economic Development, and Tourism; Hawai'i Association of Conservation Districts; University of Hawai'i College of Tropical Agriculture and Human Resources; Department of Agriculture; Coastal Zone Management Program; and Hawai'i State Civil Defense. Several City Council and State Legislature members are also very active in water resource management issues.

Private enterprise (e.g. hotel land developers, small and large scale agriculture, energy), non-profits (e.g., The Nature Conservancy), Kamehameha Schools, and local community groups (e.g., neighborhood boards) have also been targeted. Please see **Appendix A** for a list of agencies and their representative's positions targeted in the Central O'ahu Watershed study.

Please provide a list of 1 - 5 research findings:

- State-of-the-art General Circulation Models (GCM) simulation of the mean cloud climatology in the tropical and subtropical Pacific region is very poor. A new convention scheme using the iRAM model with improved boundary layer conditions and warming scenarios shows more accurate cloud dynamics in subsidence areas. This results in a reduction in less efficient reflection of solar radiation and shortwave cloud forcing. As cloud feedbacks to imposed climate forcings account for a great deal of the uncertainty in global climate sensitivity estimates, this result supports high-end current estimates of sensitivity. (Zhang et al., *in press*)
- Using the improved iRAM simulations of regional cloud dynamics in the Pacific, Drs. Axel Lauer, Kevin Hamilton et al. found that the impact of global warming scenarios and raised sea surface temperatures on Pacific region clouds amplifies warming trends. These improved cloud simulations provide evidence pointing towards the high end of current global climate sensitivity estimates (Lauer et al., 2010)



From Lauer et al., 2010. (Fig. 5) The 10-yr average change in (middle) low-level cloud amount (DCA), (bottom) cloud feedback parameters (λ), and (top) the underlying global warming signals in sea surface temperatures (DSST) for (left to right) the three global warming cases A–C compared with present-day conditions (1999–2008).

- In-depth interviews with key stakeholders in the Central O`ahu Watershed revealed: (1) a range of fresh water resource management decisions that are either currently or could potentially be informed by climate information, (e.g. development planning, energy security,

irrigation strategies); (2) various planning timelines across stakeholder groups ranging from less than one year to decades; (3) varying contextual factors constraining/facilitating to use climate information (e.g., permitting process doesn't allow for long-range planning, agricultural planning demands long-term information, but legislature not providing funds); and (4) varying levels of knowledge about where/how to access climate information.

- The sea-level rise in the US Affiliated Pacific Islands for 1997 to 2008 maintains a close correspondence with the faster rate of predicted average global sea-level rise, higher than the general global projections made by the IPCC. (Chowdhury et al., 2010)
- Ongoing review of the Hawai'i State Water Code and related regulations shows that water shortages are currently determined on an ad hoc basis using a poorly constrained set of criteria that do not assess the probability or severity of climate-driven changes in water supply. The current framework is based solely on historical changes in water supply, leading to the conclusion that new models of water supply legislation/regulation based on current scientific, indigenous, and stakeholder climate knowledge are needed.

Please provide a summary of 1 - 5 ACCOMPLISHMENTS from your research activities and stakeholder collaborations:

The first seven months of the Phase II Pacific RISA has concentrated on nurturing existing partnerships and developing new relationships with stakeholders, especially those who have been identified as central to the Central O`ahu Watershed assessment project. In addition, Pacific RISA has been actively establishing team processes, initiating research protocols, and updating its public presence via the public webpage, informational brochures, and the conceptualization and drafting of several short, stakeholder-targeted fact sheets. These fact sheets are being edited by the EWC Science Communications Specialist, an EWC leveraged resource. We have also established an Advisory Committee comprised of experts from around the Pacific Region and beyond (**see Appendix B**).

- For the Central O`ahu Watershed project, the Assessment Services team (EWC and ICAP) has conducted a total of 15 in-depth interviews to date, using a semi-structured interview protocol (**Appendix C**). Interviewees include water resource managers, administrators in state and federal agencies, policymakers, landowners and land managers, neighborhood board members, cultural practitioners and water users. The team aims to engage further stakeholders in written surveys and workshops. Early informal meetings also involved officials from the State of Hawai'i Commission on Water Resource Management and administrators at the Honolulu Board of Water Supply
- The framework for external-evaluation of Pacific RISA was developed with input from collaborator Dr. Susanne Moser and Dr. Finucane's revised Logic Model (**Appendix D**). Dr. Moser established foundational knowledge among team members about evaluation, and conveyed the importance of evaluation for the Pacific RISA's ongoing growth and broader social science contributions. Dr. Moser also provided team members with a Project Tracking Template, (**Appendix E**), which was used for the purposes of this Progress Report.

- Dr. Aly El-Kadi and his group at the WRRC, in collaboration with the USGS Pacific Islands Water Science Center, have developed expertise for the analysis of rainfall and temperature data to produce maps of rainfall intensity, identify periods of severe drought, and assess the environmental lapse rate. The results of these analyses are used to develop different input climate scenarios for water balance modeling. Such modeling will provide spatially distributed estimates of groundwater recharge as input to the numerical groundwater model.
- In February 2011, ICAP and the University of Hawai`i Kamakakūokalani Center for Hawaiian Studies convened a roundtable of natural resource specialists and decision-makers to review current trends affecting water supply and explore approaches to improve resiliency in Hawai`i's freshwater systems. Held in Halau O Haumea, a shared-use auditorium for campus and community groups, the event was second in the *`O Ke Au I Kāhuli: Pehea Lā Ka Hawai`i E Pono Ai?* series of traveling forums. Over 70 members of the campus and broader community were in attendance. Speakers included William Aila, Jr., Director of the State of Hawai`i Department of Land and Natural Resources and Dr. Tom Giambelluca, Professor of Geography at the University of Hawai`i at Mānoa. Panelists responded to over 25 audience questions, and identified a number of potential adaptation tools and several possible priority areas for revising existing programs, laws and administrative procedures, on which ICAP will concentrate research efforts.
- There is continual development of new Pacific RISA-related media. Project Manager Dr. Victoria Keener updated the public webpage, www.PacificRISA.org, with current research projects, maps, collaborations, contacts, and informational links. For internal communications, all projects, presentations, research articles and reports, stakeholder meetings, and conferences attended are updated and stored on a comprehensive project-based Google-Site. Maintenance of these sites is done by Project Assistant Rachel Miller. Additionally, with comments and feedback from the Core Team, Project Assistant Rachel Miller led the development of a new brochure (**Appendix F**) and logo for Pacific RISA.

Please provide a summary of 1 - 5 research projects and stakeholder collaborations IN-PROGRESS:

- Dr. Kevin Hamilton and his group at the University of Hawai`i, IPRC are close to producing preliminary downscaled climate change simulation data on an island level for the state of Hawai`i, and are planning on conducting diagnostic analyses incorporating the new CMIP5 data into the regional Hawai`i climate models.
- The IPRC group is currently in discussions with Dr. Aly El-Kadi at the WRRC and Steve Anthony from the USGS on the types and format of data produced by the climate models for simplifying its incorporation into the regional and local hydrological models and water budgets developed for the County of Maui, Department of Water Supply, in the Iao-Waihe`e Aquifer.

- The Central O`ahu Watershed assessment project is entering its second phase. Having completed the in-depth interviews, the Assessment Group (EWC and ICAP) is preparing to administer the written survey to the targeted stakeholders (**draft, Appendix G**). Preliminary findings including descriptive statistics and social network analysis from the interviews and survey will be drafted into a report. These findings and report will also be shared during phase three of the project, the stakeholder workshops. Two half-day workshops targeting different sectors of identified stakeholders have been scheduled for early July, 2011. Workshops will be structured and facilitated with the particular aim to bring forth participant views on the types of research, tools, and information needed to support climate adaptation efforts related to fresh-water sustainability.
 - Peggy Denny (Program Administrator, i*recycle Program, Guam) and Sam Walker (Center for Island Sustainability, University of Guam) agreed to participate as observers, to dialog about potential for doing similar research in Guam.
 - Taylor Savusa (Special Districts Manager, American Samoa Power Authority (ASPA)) will also be participating as an observer to determine potential for doing similar work in American Samoa.
 - Dan Ferguson from CLIMAS will be attending and observing the second stakeholder workshop.
 - Dr. Wendy Lin Bartels (Post-doctoral researcher, University of Florida and SECC) will be meeting with us in early August to provide input and post-workshop data evaluation.
- ICAP is proceeding with an analysis of climate adaptation law and policy. Some of the initial findings will be presented for stakeholder feedback at the Central O`ahu Watershed workshops in July, 2011. The report with incorporated stakeholder input will be presented for policymaker consideration in the 2012 State of Hawai`i legislative session. Lessons learned will be considered when repeating the streamlined process for neighbor islands in Hawai`i and other US American Pacific Islands.
- ICAP will conduct research into indigenous environmental knowledge (IEK) and place-based strategies for water resource management and adaptation to climate variability, and will complete the hire of an IEK Research Specialist in early May, 2011. They will use and integrate lessons learned from the statewide law and policy evaluation, studies of aquifers on O`ahu and Maui, and IEK research into the subsequent case studies.

Top 5-7 highlights of communicating or translating science to decision makers:

- A press release went out about the IPRC's findings in the Lauer et al., 2010 paper (cited in next section) on the impacts of global warming on marine boundary layer cloud-dynamics in the Pacific. This paper was used as the basis for interviews with Drs. Kevin Hamilton and Axel Lauer, resulting in articles in the Discovery Channel News (<http://news.discovery.com/earth/clouds-may-make-warming-worse.html>), New Scientist (<http://www.newscientist.com/article/mg20827893.400-goodbye-grey-skies-hello-extra-warming.html?DCMP=OTC-rss&nsref=environment>), Japan Herald

(<http://story.japanherald.com/index.php/ct/9/cid/c4f2dd8ca8c78044/id/713730/cs/1/>), Tehran Times (<http://www.tehrantimes.com/PDF/11025/11025-6.pdf>), and China's Yeeyan News (<http://article.yeeyan.org/view/189830/153238>)

- On September 23, 2010, Lisa Kubota with the program Sunrise: Hawaii News Now interviewed Co-PI Dr. Cheryl Anderson at the Hawaii Agricultural Conference about the research project she was conducting related to drought in Hawaii. The drought project, funded by the NOAA Climate Program Office's Sectoral Applications Research Program on Water and Drought, focused on understanding socio-economic impacts from drought in order to better identify ways to reduce these impacts through hazard and drought mitigation plans. The conference provided an opportunity to distribute public awareness information with the State's Drought Coordinator and hosted a panel session on drought to discuss tools available to reduce drought risk.
- In September 2010 Pacific RISA Project Assistant Rachel Miller participated in two dialogues conducted by the Pacific Climate Information System (PaCIS) in Guam and American Samoa entitled "Dialogue with Local Decision-makers about Water Resource and Drought-related Issues in Light of a Changing Climate." Miller traveled with a team of 5 researchers from various branches of NOAA and PEAC as well as the Pacific Islands Climate Change Cooperative (PICCC) to Guam on September 13-15 and to American Samoa on September 20-23. The team conducted meetings in both places with diverse stakeholders to discuss local needs, capacity, and decision-making capabilities in regard to water resources and climate change more broadly. Meetings in Guam included stakeholders from the Telecommunication and Distance Education Operation (TADEO) / PeaceSat; US Senator B.J. Cruz's office; University of Guam Water and Environmental Research Institute (WERI), Marine Lab, Center for Island Sustainability; the US National Park Service; National Weather Service Guam, Weather Forecast Office; Bureau of Statistics and Planning; and the Department of Agriculture. Meetings in American Samoa included stakeholders from American Samoa Community College Land Grant Office; National Weather Service Samoa, Weather Forecast Office; Department of Marine and Wildlife Resources; Haleck Enterprises; Pago Pago Pure Water; Department of Homeland Security; National Park Service; American Samoa Power Authority; Island Breeze Water; Department. of Agriculture; Department of Commerce; Pacific Energy; Coral Reef Advisory Group; Department of Health; Department of Public Works; Department of Education; Bluesky Communications; Department of Parks and Recreation; American Samoa Visitors Bureau; and American Samoa Environmental Protection Authority.
- Dr. Nancy Lewis attended and presented "*Islands in a Sea of Change: Climate Change, Health and Human Security in Small Island States*", for the NATO Advanced Workshop on "Climate Change, Human Health and National Security" in Dubrovnik, Croatia April 27-29, 2011. Dr. Lewis also presented "*Climate Change, Health and Human Security; Small Island States and Asia's Coastal Megacities*", at the Association of American Geographer's meeting, April 13-17, 2011.

- Dr. Axel Lauer gave a public presentation on the “*State of Regional Atmospheric Modeling for the Hawai‘i Climate Prediction Problem*” at the SOEST Workshop on the Science of Climate Change in Hawai‘i, Honolulu, January 19-20, 2011.
- Dr. Melissa Finucane gave a public presentation on “*Pacific RISA: The Climate Adaptation Partnership for the Pacific*,” at the SOEST Workshop on the Science of Climate Change in Hawai‘i, Honolulu, January 20, 2011. Dr. Finucane also presented a poster on “*Climate Adaptation by Pacific Islanders: Integrating Physical and Social Sciences to Support Decision Making about Complex Systems on Multiple Timescales*” at the Annual Meeting of the Society for Judgment and Decision Making, St Louis, MO, November 19-22, 2010.
- Attendance of the Pacific RISA Project Manager, Dr. Victoria Keener, at the NOAA/Sea Grant Climate Adaptation Workshop during April 18-21 in Maui, Hawai‘i. Victoria informally discussed downscaling of climate information for island-specific water resource planning with many County of Maui Water and Planning representatives.

List of completed publications, white papers, or reports (with internet links if possible):

Burkett, M. (January, 2011) In Search of Refuge: Pacific Islands, Climate-Induced Migration, and the Legal Frontier. *Asia-Pacific Issues*, 98: pp1-8.

<http://www.eastwestcenter.org/fileadmin/stored/pdfs/api098.pdf>

*Chowdhury, R., Barnston, A.G., Guard, C., Duncan, S., Schroeder, T.A., Chu, P.S. (October, 2010) Sea-level variability and change in the US-affiliated Pacific Islands: Understanding the high sea levels during 2006–2008. *Roy. Met. Soc. Weather*. 65(10): 263-268. <http://www.soest.hawaii.edu/MET/Hsco/Paper/Weather-65-10263-68.pdf>

*Communicated to PEAC stakeholder list (approximately 250 ranchers, farmers, water and natural resource managers, citizens, and businesses) through quarterly print and online newsletter.

+Lauer, A., Hamilton, K., Wang, Y., Phillips, V.T.J., Bennartz, R. (November, 2010) The Impact of Global Warming on Marine Boundary Layer Clouds over the Eastern Pacific- A Regional Model Study. *Journal of Climate*, 23(21): pp. 5844-5863.

<http://iprc.soest.hawaii.edu/users/kph/paper/2010jcliLaueretal.pdf>

+A press release that went out about this paper was used for interviews and articles as cited above.

#Zhang, C., Y. Wang, K. Hamilton. (2011) Improved representation of boundary layer clouds over the Southeast Pacific in WRF-ARW using a modified Tiedtke cumulus parameterization scheme. *Monthly Weather Review*, in press.

#The modified WRF convection model has been implemented into the latest release of the WRF community atmospheric model for general use: <http://www.mmm.ucar.edu/wrf/users/wrfv3.3/updates-3.3.html>

List of links with other NOAA programs:

- The Pacific Regional Climate Service Director, Dr. John Marra, is one of Pacific RISA Co-PI's, and has a collaborative research relationship with several different researchers and groups within the Pacific RISA program.
- The Meteorologist In Charge of the NWS Pacific Office, Raymond Tanabe, (formerly James Weyman) is also a Co-PI on the RISA project, and provides guidance, data, and support to researchers.
- Pacific RISA has a close working relationship with the NOAA Pacific ENSO Applications Center (PEAC). RISA representatives attend the monthly PEAC conference call on ENSO and climate conditions throughout the Pacific region. PEAC representatives have also agreed to include Pacific RISA's forthcoming newsletter and fact-sheet series in the mail with their quarterly newsletter.
- Pacific RISA has a close working relationship with the NOAA Integrated Data and Environmental Applications (IDEA) Center, coordinating access to and use of databases about extreme climate events.
- Pacific RISA collaborates with the Western Regional Climate Center via the Pacific Climate Information System's (PaCIS) Steering Committee and working groups.
- Pacific RISA collaborates with the NOAA Pacific Services Center by participating in the Navigator's Council of the Pacific Risk Management 'Ohana (PRiMO).

List of current cross-RISA activities:

- Dialog with members of the RISA discussion group on social science methods (provided climate literacy items and shared previous survey protocols).
- Dialog with Dr. Wendy Lin Bartels at SECC and Dan Ferguson at CLIMAS regarding Central O`ahu Watershed workshop agenda and participation. Both Wendy Lin and Dan will be visiting the Pacific RISA later this summer to help plan and evaluate the workshops.
- Drafted paper on similarities of barriers to successful integration of climate information into Water Utilities and row crop farmers planning and operations, with Dr. Victoria Keener from Pacific RISA, and Dr. Wendy Lin Bartels, Dr. Norman Breuer, and Dr. Jessica Bolson from SECC.
- Attendance and participation in AACAP Climate Downscaling Workshop and webinar by Pacific RISA PM, Dr. Victoria Keener, on April 28, 2011.

APPENDIX A: Targeted Stakeholders

Organization	Position
Aiea Community Association	President
AECOS, Inc.	President Vice-President
American Water Works Association: Hawaii	AWWA Hawaii Section Chair
Association of Hawaiian Civic Clubs	
'Ahahui Siwila O Hawai'i O Kapolei Hawaiian Civic Club	President (Pelekikena)
	Director
Hawaiian Civic Club of 'Ewa-Pu'uolo	President (Pelekikena)
King Kamehameha Hawaiian Civic Club	President (Pelekikena)
Bishop Museum	Hydrologist, Hawaii Biological Survey
Castle & Cooke Hawai'i, Inc.	Director of Site Construction Senior Project Manager
The Villages of Kapolei	
Wai Kalo'i at Makakilo	
Mililani Technology Park	
City Council	District 1 District 7 District 8 District 9
Chevron Hawaii	Oahu and Hawaii
Del Monte Fresh Produce Hawai'i, Inc.	
Dept. of Agriculture	Chairperson Deputy Administrator Chairperson of DoA Deputy Director Director Planner
Agricultural Resource Management Division	
Agribusiness Development Corporation	
Dept. of Business, Economic Dev., & Tourism	
Office of Planning	
Land Use Division	
Coastal Zone Management	
Federal Consistency Program	
Land Use Commission	Executive Officer
Dept. of Design and Construction (City & County of Honolulu)	Acting Director Deputy Director
Dept. of Environmental Services (City & County of Honolulu)	
Storm Water Management Program	
Dept. of Facility Maintenance (City & County of Honolulu)	Acting Director
Dept. of Hawaiian Home Lands	Chairperson Planning Office
Dept. of Health	Acting Director Deputy Director
Office of Environmental Quality Control	
Environmental Health Administration	Deputy Director
Solid and Hazardous Waste Branch	Chief/Contact
Clean Water Branch	Deputy Director Manager
Safe Drinking Water Branch	Acting Chief

Wastewater Branch	Chief/Contact
Environmental Planning Office	Deputy Director
	Acting Manager
Dept. of Land and Natural Resources	Chairperson
	Deputy Director of Land
	Deputy Director of Water
Engineering Division	Chief Engineer
Division of Aquatic Resources	Program Manager, Aquatic Resources
	Fisheries
	Aquatic Biologist
Division of Forestry and Wildlife	Administrator
Watershed Partnerships Program	Planner
Koolau Mtns. Watershed Partnership	Coordinator
Land Division	Administrator
Historic Preservation Division	Administrator
Oahu Burial Council	
Division of State Parks	
Division of Boating and Recreation	Oahu District Manager
Office of Conservation and Coastal Lands	OCCL Administrator
Comission on Water Resource Management	Chairperson
	Hydrologic Planning Program Manager
	State Drought Coordinator
	Deputy Director of Water
Ground Water Regulation Branch	
Dept. of Planning and Permitting (City and County of Honolulu)	Director
	Deputy Director
	Chief Planner
Dept. of Transportation	Interim Director
Ewa Beach Limu Project	
	helps Henry
Ewa by Gentry Community Association	Executive Director
Gentry Homes Hawai'i	
Friends of Honouliuli	President
	Vice-President
Haseko Construction, Inc.	
Hawaii Agriculture Research Center (HARC)	Executive Director
Hawaii Community Development Authority	Executive Director
Hawaii Conservation Alliance	Interim Director
The Hawai'i Nature Center	Executive Director
Hawaii State Civil Defense	Vice Director
Hawaii State Climate Office	Hawaii State Climatologist
Hawaii Water Environment Association	President
Hawaii Water Quality Extension Program - College of Tropical Ag & Human Resources, UH	Assoc. Extension Specialist, Environmental Quality
Hawaiian Electric Company	Executive Vice President
Health of the Land	
Honokai Hale/Nanakai Gardens Community Association	
Honolulu Board of Water Supply	Manager and Chief Engineer
	Deputy Manager & Chief Engineer
	Program Administrator, Water Resources
	Chief Hydrologist-Geologist

Hula halau

Halau Hula Olana (Aiea)	Kumu Hula
Ka Pa Nani `O Lilinoe (Aiea)	Kumu Hula
Na Pua `au I Kui a Lawa (Aiea)	Kumu Hula
Hula Halau `O Pua Loke (Aiea)	Kumu Hula
Na Malama Polynesian Dance Studio (Ewa Beach)	Kumu Hula
Halau `O Ku`ulei Aloha (Ewa Beach)	Kumu Hula
Hula Halau `O Kehaulani (Ewa Beach)	Kumu Hula
Na Hula O Kaleiokapualani Christian Hula Halau (Ewa Beach)	Kumu Hula
Halau 'O Kaululaua'e (Kapolei)	Kumu Hula
Halau Hula `O Ku`uwahineu`iokalani	Kumu Hula
Ka Hale Hula O Na Ali`i O Ke Kapu Ahi (Kapolei)	Kumu Hula
Ke Kai O Kahiki (Kapolei)	Kumu Hula
Halau Hula O Ka Wehi Kau I Ka Pali (Pearl City)	Kumu Hula
Halau 'O Napuala`iikauika`iu (Waipahu)	Kumu Hula
Ku`u Wa Hula (Waipahu)	Kumu Hula
Halau Hula `O Hokulani (Waipahu)	
James Campbell Company, LLC	Vice President, Shareholder Relations
Kapolei Property Development	Vice President, Sales & Leasing
Japanese Cultural Center	
Ka'ala Farm	holopono@pixi.com
	kamu@maoorganicfarms.org
	Land Manager
Kamehameha Schools	
Kennedy/Jenks Consultants	
KEY Project	Executive Director
Larry Jefts Farms / Waikele Farms	
Leeward Community College	
Makakilo Community Association	
Malama Learning Center	Program Director
Manana Valley Farms	
Masa Fujioka & Associates	Principal-In-Charge
Mililani Town Association	Acting General Manager
The Nature Conservancy of Hawaii	Senior Scientist and Cultural Advisor
Neighborhood Commission Office (City and County of Honolulu)	
'Aiea (No. 20)	Chair
Aliamanu/Salt Lake/Foster Village (No. 18)	Chair
'Ewa (No. 23)	Chair
Makakilo/Kapolei/Honokai Hale (No. 34)	Chair
Mililani/Waipio/Melemanu (No. 25)	Chair
Mililani Mauka/Launani Valley (No. 35)	Chair
Pearl City (No. 21)	Vice-Chair/Parliamentarian
Wahiawa (No. 26)	Chair
Waipahu (No. 22)	Chair
NOAA National Marine Fisheries Service, Pacific Islands Regional Office	Acting Pacific Islands Regional Administrator
	Assistant Regional Administrator - Habitat
NOAA Ocean and Coastal Resource Management	Acting Director
	Acting Deputy Director
Oahu Land Trust Board	
Oahu Resource Conservation & Development	Executive Director
	Project Manager - Watershed Planning

Office of Hawaiian Affairs

Office of the Lieutenant Governor
Office of the Governor
OmniGreen Renewables
Pacific Services Center (NOAA)

Palehua Community Association
Pearl Harbor Area Restoration Advisory Board
Pearl Harbor Hawaiian Civic Club
Pearl Harbor Naval Complex, USEPA

The Queen Emma Foundation
The Resort Group (Ko Olina)
Robinson Estate
Rotary Club of Kapolei
State Legislature

Soil and Water Conservation Society - Pacific Islands Area
Chapter
South Oahu Soil and Water Conservation District
Sumida Watercress Farm

Sumida Watercress / Pioneer Hi-Bred

Land Manager
Researcher
Land Intern
Lieutenant Governor
Governor
Owner
Geospatial Technician
Director
Deputy Director

President
EPA Site Manager
Potentially Responsible Parties (PRP) Contact

President
35 - Pearl City, Waipahu
44 - Honokai Hale, Nanakuli, Lualualei, Maili
42 - Waipahu, Honouliuli, West Loch, Ewa
41 - Waipahu, Village Park, Waikele
40 - Royal Kunia, Makakilo, Kapolei, Kalaeloa
32 - Lower Pearlridge, Aiea, Halawa, Hickam, Pearl Harbor, Moanalua Gardens
33 - Aiea, Halawa Valley, Halawa Heights, Aiea Heights
43 - Ewa Beach, Iroquois Point, Puuloa
34 - Newtown, Waiiau, Pearl City, Waimalu
36 - Pearl City, Momilani, Pacific Palisades, Manana
22 - Mililani Mauka, Wahiawa, Hale'iwa, Mokule'ia, North Shore
20 - 'Ewa Beach, 'Ewa by Gentry, Ocean Pointe, 'Ewa Villages, West Loch, Honouliuli, Lower Waipahu
19 - Waikele, Village Park, Royal Kunia, Makakilo, Kapolei, Kalaeloa, Honokai Hale, Portions of Waipahu and Ko 'Olina
16 - Pacific Palisades, Pearl City, Waimalu, Upper 'Aiea, 'Aiea Heights
18 - Waipahu, Pearl City, Crestview
21 - Ko Olina, Kahe Point, Nanakuli, Ma'ili, Wai'anae, Makaha, Makua, Ka'ena Point
15 - Kalihi, Moanalua Gardens, Salt Lake, Aliamanu, Foster Village, Hickam, Pearl Harbor, Pearl Ridge, 'Aiea

President
Chair
Operations Manager
Sumida: Entomologist Pioneer:
Agronomy Research Scientist

The Trust for Public Land, Hawaii Office
 U.S. Air Force
 US Army Corps of Engineers, Pacific Ocean Division
 US Army Corps of Engineers, Pacific Ocean Division, Honolulu District

US Army Corps of Engineers, Honolulu District
 US Army Garrison, Hawaii (USAG-HA), Directorate of Public Works, Environmental Div.

USDA Natural Resources Conservation Service - Pacific Islands Area

USEPA Region 9, Water Division
 USFWS Pacific Islands Fish and Wildlife Field Office
 USFWS Pearl Harbor National Wildlife Refuge
 USGS Pacific Islands Water Science Center

US Navy, Naval Facilities Engineering Command (NAVFAC), NAVFAC Hawaii
 Villages of Kapolei Association
 Waipahu Community Association
 Water Resources Research Center / UH Dept. of Civil and Environmental Engineering

Water Resources Research Center / UH Dept. of Geology and Geophysics
 West Loch Estate Homeowners Association
 West Loch Fairways Community Association
 West Oahu Current / Leeward Current / Ka Nupepa
 West Oahu Soil and Water Conservation District
 Western Pacific Regional Fishery Management Council
 William S. Richardson School of Law, University of Hawaii at Manoa
 Wilson Okamoto Corporation

Local high school history teachers

Media Contact

Division Contact

Honolulu Contact
 Project Manager

Watershed Program Manager, Civil and Public Works Branch

Chief, Environmental Division
 Natural Resources Manager
 Garrison Commander

Director
 Water Quality Specialist
 Civil Engineer, Watershed Planning

Field Supervisor
 Project Leader
 Director
 Hydrologist
 Hydrologist

Public Affairs Officer
 President

Professor of Civil and Environmental Engineering
 Professor (Emeritus), Civil and Environmental Engineering
 Associate Researcher and Assistant Director, WRRC

Executive Director

Assistant Professor of Law
 President
 freelance consultant

APPENDIX B: Pacific RISA Advisory Committee Members and Overview

Title	Organization	Location
Superintendent	Fagatele Bay National Marine Sanctuary, NOAA	American Samoa
State Drought and Water Conservation Coordinator	Hawaii Commission on Water Resource Management, Hawaii Department of Land and Natural Resources	Honolulu, Hawaii
Meteorologist	NOAA NWS Climate Prediction Center	Camp Springs, Maryland
Professor of Water Resources Engineering	Water and Environmental Research Institute of the Western Pacific, University of Guam	Mangilao, Guam
MPA Program Manager	Ministry of Resources and Development	Koror, Palau (Townsville, Queensland)
Chief	Climate Services Division of the NOAA National Climatic Data Center	Ashville, North Carolina
Assistant Professor of Law	William S. Richardson School of Law, University of Hawaii at Manoa	Honolulu, Hawaii
Meteorologist in Charge Operational Climate Applications Specialist	NOAA Weather Service Office <i>Retired</i>	Majuro, MH Midland, Texas
NOAA Coastal Storms Program Pacific Region Coordinator	University of Hawaii Sea Grant College Program	Honolulu, Hawaii
Executive Director	Commonwealth Utilities Corporation	Saipan, CNMI

Pacific RISA Advisory Committee

Overview

Goals

1. To provide diverse, expert perspectives on the context (climatological, environmental, social, economic, legal, cultural) in which the Pacific RISA program activities are being implemented.
2. To provide feedback and recommendations about the existing and planned activities of the Pacific RISA program.

Composition

The Advisory Committee comprises approximately nine people from Hawai‘i and the US-Affiliated Pacific Islands. Relevant backgrounds include climate science, resource management, hazards mitigation, and socio-cultural expertise relevant to improving climate adaptation research and outreach activities. Committee members will represent diverse sectors and government and non-government organizations.

Specific Activities

1. **Meet** twice a year in person or via videoconference, with follow-up phone calls and emails as needed between meetings.

2. **Provide expert knowledge** about key regional issues related to climate adaptation, climatological and environmental trends, and upcoming political, legislative, and regulatory developments.
3. **Provide strategic insights** on the Pacific RISA work plan, ways to overcome road blocks or capitalize on opportunities that arise, and long-term planning.
4. **Network** the Core Research Team with relevant organizations and individuals throughout the region.
5. **Serve** as advocates for the Pacific RISA program, enhancing our public standing.

Benefits

Members of the Advisory Committee will benefit from hearing about state-of-the-art research and other activities being conducted by the Pacific RISA team. Members will also benefit from being part of a network of partners with diverse skills and interests. The Pacific RISA program will benefit from the external perspectives and strategic thinking provided by diverse individuals around the Pacific region.

APPENDIX C: Interview Questions

Assessing Risks, Vulnerabilities, and Capacities Related to Decisions about the Sustainability of Fresh Water Resources in Pacific Island Settings

Section I: Fresh Water Resource Management Decisions

1. We're interested in understanding how different organizations are involved in managing water resources in the Central O'ahu Watershed. Please tell us about your agency's responsibilities.
2. **What specifically does your work involve?**
 FUP A: So you manage... What does that mean for your daily duties?
 FUP B: Who do you interact with regularly to accomplish this?
 FUP C: How long have you been in this position?
3. You have mentioned **X distinct kinds of decisions** that you are involved in making. We would like to understand these better. Let's take these one at a time.

Decision A [do for each]

FUP A: Can you describe the **decision-making process** more:

- Who initiates this decision process?
- Who else is involved and what roles do they play? [Probe for anyone with roles in analyzing, communicating, or disseminating information about climate impacts on PH aquifer.]
- Are your decisions reviewed by someone else? Can anyone appeal or change your decisions? How does that process work?
- What information and tools do you currently use in making these kinds of decisions?
- Is there any kind of regularity to when you make this decision (e.g., in the water year or in the budget cycle)?

Section II: Impact of Climate Variability and Change on Decisions about Fresh Water Resources

4. In your view, in what **ways is the management of fresh water resources sensitive to climate or variations in climate?**
 FUP A: What are the most important climatic events or issues you care most about?
 FUP B: Tell me about one of these events in your experience? What happened and how did this affect your decision making?
5. In what **ways can you imagine the changing climate might affect the decisions you face about Central O'ahu fresh water resources?**
 FUP: Say more...
6. Have you, or has your agency, **begun to systematically examine potential impacts**

from climate change on the sustainability of fresh water resources from the Central O‘ahu watershed?

FUP A: If yes, ask for copies of studies or reports.

FUP B: If no, why do you think you haven’t yet looked at this issue?

FUP C: What, if anything, might lead you to consider climate change in your decision processes?

Section III: Need For and Capacity to Use Climate Information in Decisions about Fresh Water Resources

7. **How familiar would you say you are with climate change** and its impacts on fresh water resources?

FUP A: How do you learn/ stay informed about climate change? To become informed or stay up-to-date, what sources of information do you find most helpful? Which do you find least helpful? In what formats and how often do you obtain this information?

FUP B: Has your agency ever provided information, held seminars or workshops, or invited speakers on the topic?

FUP C: Are there specific scientists you could consult on this issue?

- If yes, have you done so? How often do you consult them and about what?
- If no, would you find such contacts helpful? What would you most want from them?

FUP D: Do you ever talk with colleagues in your agency or with others who hold similar job responsibilities as you about climate change? What does/would make this valuable to you?

8. [Depending on how knowledgeable the interviewee, **provide scenario of CC impacts:** “Experts here project warmer air temperatures, changes in rainfall patterns with potential for more droughts and floods, potential for more severe hurricanes, and a long-term rise in sea level, all of which may impact the availability of fresh water resources...” Or **explore some potential impacts already mentioned by interviewee.**]

Record reactions, knowledgeability, perceptions.

FUP A: How serious would these impacts be for the central O‘ahu watershed?

FUP B: How do you think such changes would affect what you do in your job?

FUP C: What issues, conflicts, concerns would these types of impacts raise (in the institution, community, state, among stakeholders)?

FUP D [if stakeholders are mentioned]: Record stakeholders and collaborating agencies, etc.

9. To prepare for these potential impacts, **what kind of information would you need?**

FUP A: Who would be a trusted source of this information?

FUP B: At what point in the decision process would this information be of greatest usefulness to you?

FUP C: Would/do you use this information to initiate or end activities or implement plans (e.g., to impose or lift water restrictions)? If not, why not?

FUP D: What product or tool would help you think about climate impacts when making decisions about fresh water resources?

FUP E [if not mentioned already]: Have you heard of (and if yes, do you use the information from) any of the following websites?

- National Drought Mitigation Center's US Drought Monitor (drought.unl.edu)
- National Integrated Drought Information System's (NIDIS) US Drought Portal (drought.gov)
- NOAA's Climate Services Portal (climate.gov)
- NOAA's National Climatic Data Center (NCDC) (ncdc.noaa.gov)
- US Global Change Research Program (globalchange.gov)
- USGS National Climate Effects Network (gcp.usgs.gov)
- Pacific Regional Integrated Sciences and Assessments (Pacific RISA) (PacificRISA.org)
- Pacific Climate Information System (PaCIS) (www.noaaclimatepacific.org)
- Center for Island Climate Adaptation Policy and Planning (ICAP) (law.hawaii.edu)

10. Have you read the **report *Global Climate Change Impacts in the United States*** from the US Global Change Research Program?

FUP A: If so, how did that information affect your decisions about or response to climate change and its impacts on the US?

FUP B: Did you use that information to inform others about risks related to a changing climate?

FUP C: Did you feel better informed about climate change after reading the report?

11. Have you read **similar reports**, such as:

- *America's Climate Choices* by the National Research Council of the National Academies?
- Intergovernmental Panel on Climate Change's (IPCC) *Assessment Reports*?
- *Synthesis and Assessment Products* from the US Global Change Research Program?

FUP A: If so, how did those reports compare to others regarding your knowledge of climate-change issues and your ability to provide guidance to others?

12. The science of climate change and impacts on fresh water resources is evolving. As scientists learn more, their ability to project changes and to anticipate impacts will

improve over time. For now, however, the information available tends to be somewhat uncertain. **How does this uncertainty affect your ability to use this information?**

FUP A: How do you currently handle uncertain data in your decision making?

FUP B: Is more certainty a precondition for you to use climate-change projections? If it's not about more certainty, what would make this kind of information useful to you?

FUP C: What if the information is incorrect? What are the relative risks of false assurance (e.g., adequate water supply) or false alarms (e.g., inadequate water supply)?

FUP D: [If not mentioned already, probe for building in buffers, use of no-regrets strategies, denial or postponement, precautionary thinking, use of worst-case scenarios.]

13. Has your organization developed a **climate adaptation plan**?

- If not, how do you take climate variability and change into account right now?
- If not, does your organization plan on developing such an adaptation strategy? Where are you in that process at present?
- If yes, could we receive a copy?
- If yes, what does this plan contain that relates to your fresh water management decisions?

FUP A: Do you see short-term adjustments to climate variability and long-term adaptation planning as a continuum or do you see any trade-offs between them?

- If viewed as trade-offs: What are they?

FUP B: What does water resource sustainability planning mean to you? In what ways are these plans the same as or a part of climate adaptation planning?

FUP C: Do government agencies coordinate with each other in their adaptation planning activities? How well do agency and organization plans agree with each other?

FUP D: Does your organization's adaptation planning activities specifically address the needs of specific populations (e.g., Native Hawaiians, women, taro farmers)? If yes, how?

Section IV: Legal and Regulatory Barriers & Climate Laws and Policies

14. I'd now like to turn to the legal and regulatory framework that guides fresh water management. **What plans, policies, and /or regulations are relevant** to your work and influence your decisions? For example, the State Water Code, and Water Use and Development Plans.

FUP A: Are these plans, policies, and/or regulations based on historic rather than projected water availability? Would you say that there is flexibility in these plans and policies to take into account greater variability in climate? Can you plan ahead for the future using climate-change projections or is there some restriction on what information you can use?

FUP B: Are there other legal and regulatory limits that constrain appropriate responses to

the impacts of climate variability and change?

15. **How effective are laws and policies**, in your view, in promoting sustainable water resource management plans?

FUP A: How do we know if laws and policies are effective? How would we know the extent to which laws and policies are effective in promoting sustainable water resource management?

FUP B: How do you monitor fresh water supplies and use at present?

16. What are the top three **novel policy approaches** (such as revisions or additions to existing codes, laws, and/or plans) you would like to see?

FUP: Is there anything you need to know about laws currently on the books?

17. As a water user, **what do you see as your legal rights**, as well as your traditional access and use rights?

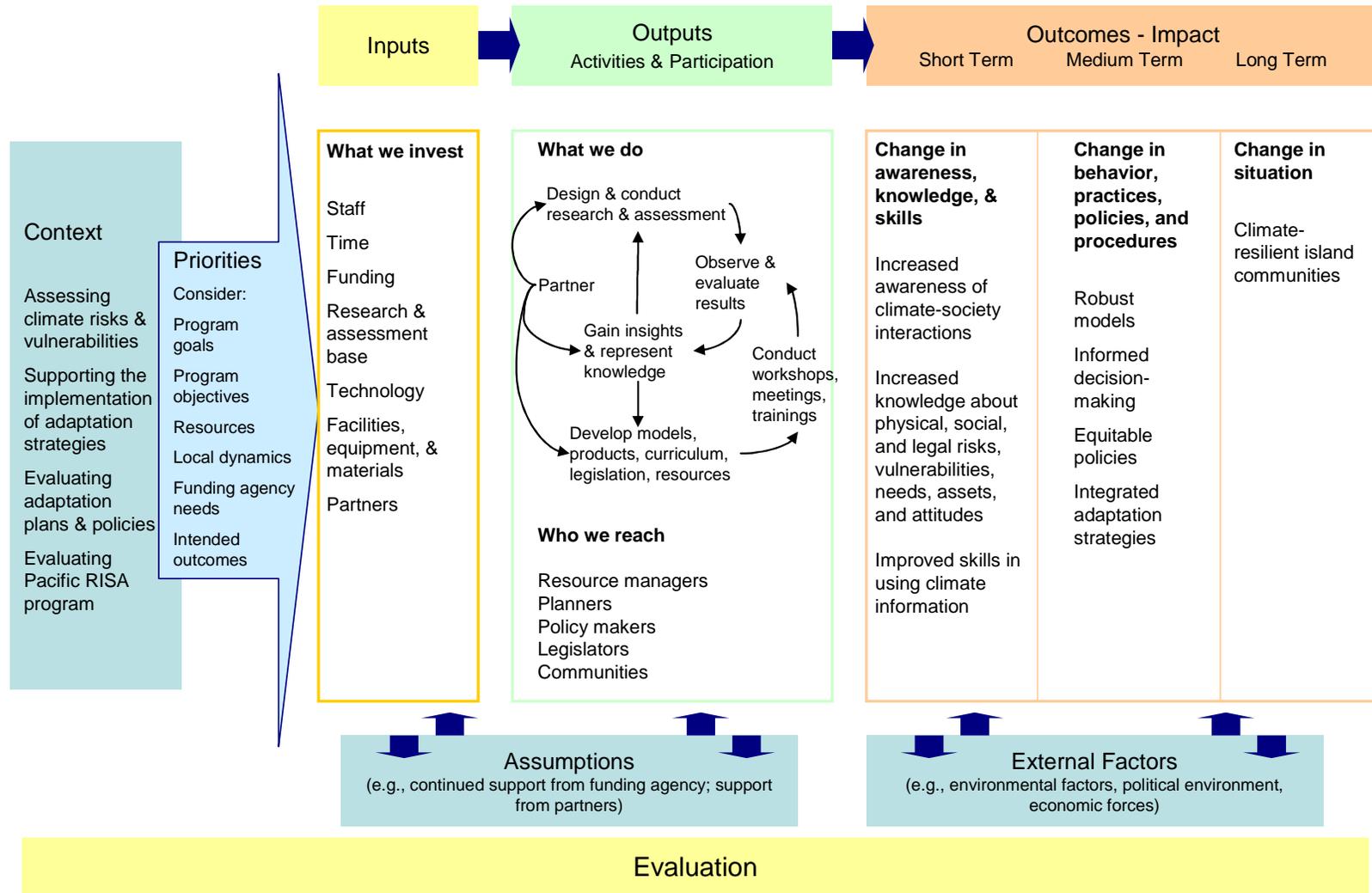
FUP: (for water managers) In what situations have stakeholders or the public raised concerns over how water is allocated for certain uses or users?

18. What would you say are the **most important considerations that drive your decisions about fresh water resource management?**

- Legal guidelines, laws, planning, policies
- Development
- Other economic pressures or constraints
- Technological options
- Institutions
- Stakeholders/interest groups

19. Is there anything else we didn't talk about that I should know about regarding the challenges and opportunities in fresh water management?

APPENDIX D: Pacific RISA Program Action-Logic Model



Outputs:**1. Research**

(Please specify numbers, short summaries, titles, and attach documents)

a. Key findings, advances, breakthroughs

b. Peer reviewed publications

c. Other reports

d. Presentations and webinars

e. Other products

2. Stakeholder Interactions/Partnerships

(specify *additional* partners and stakeholders actually reached not previously mentioned); types, numbers; summarize purpose, focus, participants, outcomes; attach additional documentation if available)

a. Pacific RISA stakeholder interactions/partnerships

b. Cross-RISA partnerships

Outcomes:

(briefly describe any qualitative observations or scientifically obtained indications of changes in awareness, understanding, attitudes, knowledge, degree of interaction, level of trust among partners, change in behavior, practice or policy)

Future Plans and Directions:

(please specify objectives and expected activities to the extent known for the next performance period)

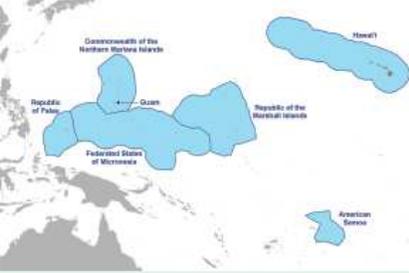
1. Objectives

2. Expected Activities

APPENDIX F: New Pacific RISA Brochure

Principal Investigators	Partnerships	 
<p>Melissa L. Finucane <i>East-West Center</i></p> <p>Nancy Lewis <i>East-West Center</i></p> <p>Cheryl Anderson <i>Social Science Research Institute, University of Hawai'i</i></p> <p>Kevin Hamilton <i>International Pacific Research Center, University of Hawai'i</i></p> <p>Aly El-Kadi <i>Water Resources Research Center, University of Hawai'i</i></p> <p>Maxine Burkett <i>Center for Island Climate Adaptation and Policy, University of Hawai'i</i></p> <p>Ray Tanabe <i>Pacific ENSO Applications Climate Center, National Weather Service</i></p> <p>John Marra <i>Pacific Regional Climate Service, National Oceanic and Atmospheric Administration (NOAA)</i></p> <p>Stephen Anthony <i>Pacific Islands Water Science Center, U.S. Geological Survey</i></p> <p>Deanna Spooner <i>Pacific Islands Climate Change Cooperative</i></p>	<p>East-West Center University of Hawai'i</p> <p>Pacific Climate Information System</p> <p>Pacific ENSO Applications Climate Center, National Weather Service</p> <p>U.S. Geological Survey</p> <p>Pacific Islands Climate Change Cooperative</p> <p>Pacific Risk Management 'Ohana</p> <p>Water and Environmental Research Institute, University of Guam</p> <p>NOAA Pacific Services Center</p> <p>NOAA Western Regional Climate Center</p> <p>Secretariat of the Pacific Regional Environment Programme</p> <p>Office of Environmental and Emergency Management, Office of the President, Federated States of Micronesia</p> <p>Office of Environmental Response and Coordination, Office of the President, Palau</p> <p>National Drought Mitigation Center at the University of Nebraska</p> <p>Local community groups throughout the region</p>	
 <p>Documenting flooding hazards, Poipu, Hawaii. Source: Cheryl Anderson.</p>	 <p>Contact:</p> <p>Melissa Finucane, PhD Tel: 808.944.7254 Email: Melissa.Finucane@EastWestCenter.org www.PacificRISA.org East-West Center Research Program Room 2062 1601 East-West Road Honolulu, HI 96848-1601 USA</p>	<p>Our Vision</p> <p>Resilient and sustainable Pacific Island communities using climate information to manage risks and make practical decisions about climate variability and change.</p> <p>www.PacificRISA.org</p>  <p>EAST-WEST CENTER COLLABORATION • EXPERTISE • LEADERSHIP</p> 

Pacific RISAs
Objectives and Activities



Pacific Regional Map. Source: Miguel Castrone.

Objective 1: Conduct place-based assessment of risk and vulnerability and develop adaptation strategies

- *Climate Projections for Pacific Islands* provide new capacity for linking climate impacts with adaptation planning capabilities at an island level.
- *Integration of Climate Projections with Hydrologic Models* supports assessment of the sustainability of ground water resources under future climate conditions.
- *Hazards and Climate Risk and Vulnerability Assessments* help communities develop disaster risk-reduction plans.
- *Human Dimensions of Drought on Pacific Islands* are examined through qualitative analyses of the social and cultural impacts of drought, societal adaptation to drought, characterization of water users, and factors affecting water use decisions.
- *Regional Climate Assessment Services through RISAs-Agency-Stakeholder Collaborations* are supported through the identification of stakeholders, their climate-sensitive decisions, and their climate-information needs.

The Pacific Regional Integrated Science and Assessment (Pacific RISAs) program strives to enhance Pacific Island communities' abilities to understand, plan for, and respond to a changing climate. We do this by conducting interdisciplinary research and building partnerships with local, national, and regional stakeholders.

Pacific RISAs emphasizes the engagement of communities, governments, businesses, and scientists in building resilience in key sectors such as water resources, coastal and marine resources, fisheries, agriculture, tourism, public health, and disaster management.

Established in 2003, Pacific RISAs is funded by the U.S. National Oceanic and Atmospheric Administration's Climate Program Office. Our region includes Hawai'i, Commonwealth of the Northern Mariana Islands, Guam, Federated States of Micronesia, Republic of the Marshall Islands, Republic of Palau, and American Samoa.



Taro fields in Keanae, east Maui, irrigated by water diverted from Palauhulu Stream. Source: Stephen Gingerich, USGS.

Biological and Physical Science Data
(Regional and island level)

Integration through partnerships
addressing how climate variability
and change will interact with population
and environmental stressors to affect
sustainable development in Pacific Islands

Social Science Data
(Household, community,
and national level)

Local Adaptation Support for Sustainable Development in Pacific Islands

- Assessment of physical, social, and economic vulnerabilities & capabilities
- Development of adaptation strategies
- Evaluation of laws, policies, & program performance

Framework of data integration for research, assessment, and outreach activities

Objective 2: Support the implementation of adaptation strategies for Pacific Island communities

- *Portfolio-Based Climate Services* build capacity in the development, analysis, and delivery of climate information tailored to the needs of disaster-management communities.
- *Stakeholder Workshops on Adaptation to Climate Change* bring together key stakeholders from across the region to ensure an understanding of climate-risk reduction planning and to establish mechanisms for engaging in the climate risk and vulnerability assessment process.

Objective 3: Evaluate adaptation plans and policy making in the Pacific region

- *Climate Adaptation Law and Policy Analysis* assists governments in preparing and adopting laws and policies that facilitate cost-effective, efficient, and equitable adaptation strategies.
- *Pacific RISAs Performance Evaluation* develops measurement tools for assessing the value of programmatic support for adaptation planning.

APPENDIX G: Climate and Fresh Water Management Survey (DRAFT)**Section 1: Information for Consent to Participate in a Research Study**

This survey is part of the Pacific RISA program (www.PacificRisa.org), which aims to help Pacific Islanders prepare for and manage the risks from climate variability and change. We provide stakeholder-driven climate information and services for communities in Hawai‘i and the US-Affiliated Pacific Islands. Pacific RISA is funded by the National Oceanic and Atmospheric Administration (NOAA).

Purpose of the Survey: This survey will help us understand how people think about the potential impact of climate variability and change on fresh water resources in the Central O‘ahu Watershed. This survey focuses on climate-change perceptions and information needs to support decision making. It will take about 30 minutes to complete all questions of the survey.

Benefits and Risks: Results of this study will be used to better understand the climate information needs of decision makers, inform future product and research and the development of useful information and services, and guide stakeholder engagement activities. Loss of privacy from survey forms is a potential but very small risk. All information about you will be kept private to the best of our ability. Your identity will not be revealed in any publication or release of results. Study information will be kept in locked files. You will not be compensated for your participation in this study.

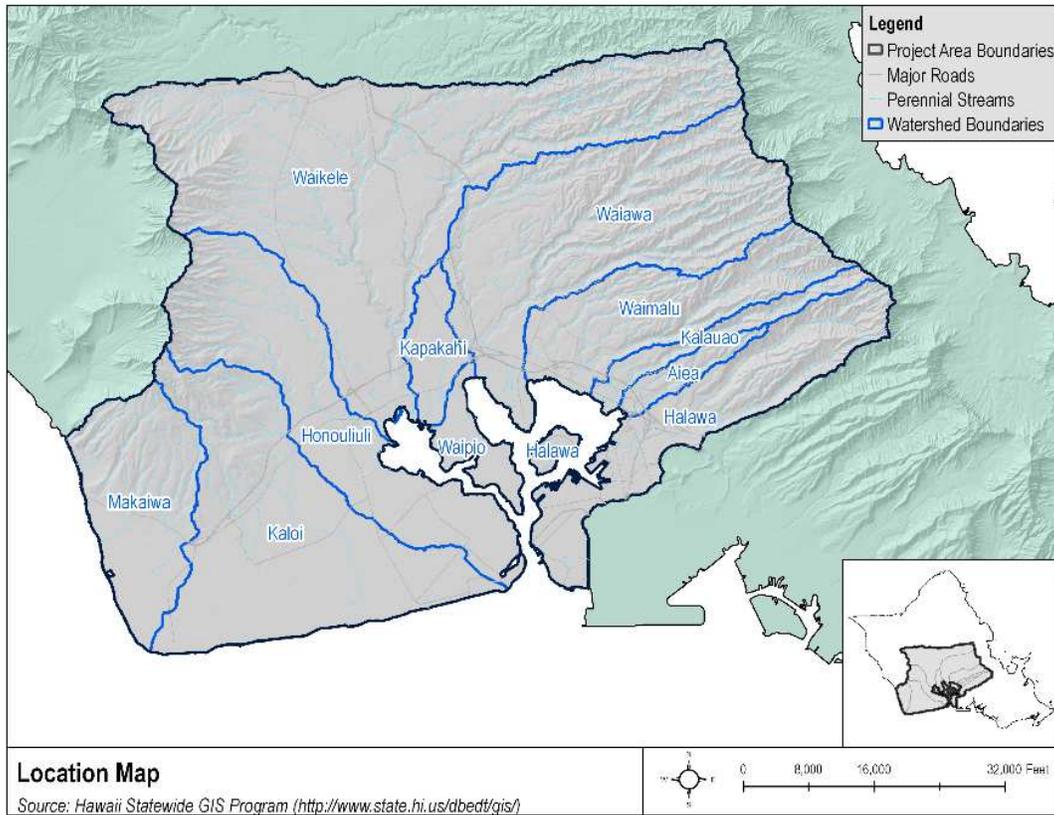
Voluntary Nature of the Study: Participation in this study is voluntary. You may refuse to answer any question or end the survey without answering all questions. A completed survey is the most useful to the researchers involved in this study.

Confidentiality: Your responses will be kept confidential. When we report responses from this survey we will not identify individuals. The records of this study will be kept private and no-one other than project staff will have access to your responses. We appreciate you providing your name on the survey so that we can track responses, but will de-identify data before reporting results.

Contacts and Questions: If you have questions or concerns about the research, please contact the Principal Investigator, Dr Melissa Finucane, Senior Fellow at the East-West Center, Honolulu HI; Melissa.Finucane@EastWestCenter.org or 808-944-7254 (tel). You may also contact the East-West Center Institutional Review Board Administrator, Ms Kimberly Fujiuchi at 808-944-7300 (tel).

Definitions: In this survey we use the term *climate* to refer to average weather over a period of about 25-30 years. *Climate variability* refers to short-term (between about 1-10 years) deviations from the 25-30 year average. This is the range of conditions that can occur under today's climate, including periods of warmer/colder and wetter/drier conditions and extreme events such as droughts, floods, and heat waves. *Climate change* refers to a long-term (~25 year) increase or decrease in average measures of climate such as temperature, precipitation, etc. When we refer to climate change, we mean future climate which is likely to be different from today's climate. By the term *fresh water resources* we mean ground water from aquifers and surface water in perennial streams.

Some of the survey questions refer to the *Central O‘ahu Watershed*. This area primarily consists of the Pearl Harbor area and upland areas in the central corridor between the Ko‘olau and Wai‘anae Ranges. A map of the area is given below.



The Central O‘ahu Watershed area includes all the streams and their related land areas that drain into the Pearl Harbor estuary as well as lands of the ‘Ewa District to the boundary of the Wai‘anae District.

Section 2: Climate Variability and Change in Hawai‘i

1. How much experience you have had managing the impacts of the following types of events in Hawai‘i?

	No experience	Some experience	Moderate experience	A lot of experience
Storms and hurricanes	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
Flooding	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
Drought	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
Coastal inundation	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
Ocean acidification	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄

2. Please indicate your agreement or disagreement with the following statements

	Strongly disagree	Disagree	Agree	Strongly agree
My work is affected by El Niño or La Niña events	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
It is helpful to know if the coming season’s climate will be different from what is typical for the area in which I work	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
It is helpful to know how extreme climate events impact Hawai‘i	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄

3. How likely do you think it is that each of the following will occur in Hawai‘i during the next 50 years as a result of climate change?

	Not at all likely	Somewhat likely	Very likely	Extremely likely
Worse storms and hurricanes	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
Worse droughts	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
Salt water intrusion into ground water	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
Flooding of cities	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
Water shortages	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
Food shortages	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄

Sea level rise	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
Increased rates of disease	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄

Section 3: Fresh Water Resources in the Central O’ahu Watershed

4. How worried are you about the impacts of climate change on fresh water resources in the Central O’ahu Watershed?

- Not at all worried 1
- A little worried 2
- Moderately worried 3
- Very worried 4

5. Do you think climate change will have a dangerous impact on fresh water resources in the Central O’ahu Watershed?

- No, it is not dangerous 1
- Yes, it is dangerous now 2
- Yes, it will be dangerous in 10 years 3
- Yes, it will be dangerous in 25 years 4
- Yes, it will be dangerous in 50 years 5
- Yes, it will be dangerous in 100 years 6
- Don’t know 7

6. What impact do you think climate change will have on the availability of fresh water resources in the Central O’ahu Watershed?

- More fresh water will be available 1
- Less fresh water will be available 2
- No change in availability 3
- Don’t know 4

7. What impact do you think climate change will have on the quality of fresh water resources in the Central O’ahu Watershed?

- Fresh water quality will be better 1
- Fresh water quality will be worse 2
- No change in quality 3
- Don’t know 4

8. Assuming climate change will have an impact on fresh water resources in the Central O’ahu Watershed, how concerning is this for

	Not at all concerning	Somewhat concerning	Very concerning	Extremely concerning
Native plant and animal species	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
Future generations of people	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
Your community	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
You personally	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
Native Hawaiian traditional access and practices	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
Agriculture	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
Industry	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
Infrastructure (e.g., roads, buildings)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄

9. Personally, do you think that you are well informed or not about...

	Not at all informed	Not very well informed	Fairly well informed	Very well informed
The likelihood of changes to fresh water resources in the Central O’ahu Watershed as a result of climate variability and change	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
The consequences of climate variability and change for fresh water resources in the Central O’ahu Watershed	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
How to prepare for changes to fresh water resources in the Central O’ahu Watershed as a result of climate variability and change	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄

Section 4: Climate Science Perceptions

10. In your view, do most scientists agree or disagree with one another about whether climate change is happening?

- Most scientists think climate change is happening 1
- Most scientists think climate change is not happening 2
- There is a lot of disagreement among scientists about whether or not climate change is happening 3
- Don’t know 4

11. Assuming climate change is happening, do you think it is caused mostly by things people do, mostly by natural causes, or by both?

- Mostly by things people do 1
- Mostly by natural causes 2
- Both equally 3
- Don't know 4

12. You may have heard that the climate is changing because of greenhouse gas emissions. How convinced are you that this has been happening?

- Completely convinced 1
- Mostly convinced 2
- Not so convinced 3
- Not at all convinced 4
- Don't know 5

13. How much do you feel you know about climate change?

- Nothing 1
- A little 2
- A moderate amount 3
- A lot 4

14. In your opinion, is each of the following statements true or false?

	True	False	Don't know
Weather changes from year to year	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃
Climate means the average weather conditions in a region	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃
Climate changes from year to year	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃
Ocean currents carry heat from the equator toward the north and south poles	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃
The greenhouse effect keeps the earth from being as cold as outer space	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃
The temperature of the earth is affected by whether the earth's surface is light or dark colored	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃
A major cause of climate change is pollution/emissions from business and industry	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃

A major cause of climate change is the use of aerosol spray cans	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃
A major cause of climate change is electrical generation from fossil fuels such as coal	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃
If we were to stop burning fossil fuels today, the amount of carbon dioxide in the atmosphere would decrease almost immediately	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃
If we were to stop burning fossil fuels today, global warming would stop almost immediately	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃
Climate change will cause some places to get wetter, while others will get drier	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃
Climate change will increase crop yields in some places, and decrease it in others	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃
Climate change will cause temperatures to increase by roughly the same amount in all countries	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃

Section 5: Information Use, Constraints, and Needs

15. How often do you use observations of current conditions for the climate indicators listed below to help guide your decision making?

	Not familiar with this indicator	Heard of this indicator, but never use it	Consult yearly	Consult seasonally	Consult monthly	Consult weekly	Consult more than weekly
Observed precipitation	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₆	<input type="checkbox"/> ₇
Observed temperature	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₆	<input type="checkbox"/> ₇
Observed streamflow	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₆	<input type="checkbox"/> ₇
Observed reservoir storage	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₆	<input type="checkbox"/> ₇
Observed reservoir inflow	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₆	<input type="checkbox"/> ₇
Observed soil moisture	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₆	<input type="checkbox"/> ₇
Observed evapotranspiration	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₆	<input type="checkbox"/> ₇
Observed ENSO signal	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₆	<input type="checkbox"/> ₇

16. How often do you use seasonal forecasts for the climate indicators listed below to help guide your decision making?

	Not familiar with this indicator	Heard of this indicator, but never use it	Consult yearly	Consult seasonally	Consult monthly	Consult weekly	Consult more than weekly
Precipitation forecasts	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₆	<input type="checkbox"/> ₇
Temperature forecasts	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₆	<input type="checkbox"/> ₇
Streamflow forecasts	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₆	<input type="checkbox"/> ₇
Reservoir storage forecasts	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₆	<input type="checkbox"/> ₇
Reservoir inflow forecasts	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₆	<input type="checkbox"/> ₇
Soil moisture forecasts	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₆	<input type="checkbox"/> ₇
Evapotranspiration forecasts	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₆	<input type="checkbox"/> ₇
ENSO signal forecasts	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₆	<input type="checkbox"/> ₇

17. At what geographic scale is information about climate variability and change most relevant when you make decisions?

	Never	Sometimes	Often
Local scale (e.g., specific to a valley or town)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃
Island scale	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃
Statewide scale	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃
Regional scale	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃

18. How often do you rely on the following sources for information about the impacts of climate change?

	Never	Occasionally	Often	Very often	Don't have any experience with this source
University of Hawai'i	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
US Geological Survey	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
Scientific journals	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
Professional listservs	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
Private corporations	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
Non-profit environmental organizations	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅

National Oceanic and Atmospheric Administration					<input type="checkbox"/> 5
US Drought Monitor website	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
National Weather Service's Climate Prediction Center website	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Hawai'i Water Resource Protection Plan	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
State of Hawai'i Commission on Water Resource Management	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
City and County of Honolulu Board of Water Supply	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Office of Hawaiian Affairs	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
State Department of Hawaiian Home Lands	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Television weather reporters	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Family and friends	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Other (please specify: _____)	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

19. How much do you trust the following sources of information about the impacts of climate change?

	Not at all trustworthy	A little trustworthy	Moderately trustworthy	Highly trustworthy	Don't have any experience with this source
University of Hawai'i	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
US Geological Survey	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Scientific journals	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Professional listservs	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Private corporations	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Non-profit environmental organizations	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
National Oceanic and Atmospheric Administration	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
US Drought Monitor website	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
National Weather Service's Climate Prediction Center website	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Hawai'i Water Resource	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

Protection Plan

State of Hawai'i Commission on Water Resource Management	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
City and County of Honolulu Board of Water Supply	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
Office of Hawaiian Affairs	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
State Department of Hawaiian Home Lands	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
Television weather reporters	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
Family and friends	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
Other (please specify: _____)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅

20. How much have you relied on the following reports to aid your decisions about how to respond to the impacts of a changing climate?

	Not at all	A little	A moderate amount	A lot	Don't know this source
<i>Global Climate Change Impacts in the United States</i> by the US Global Change Research Program	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
<i>Synthesis and Assessment Products</i> by the US Global Change Research Program	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
<i>America's Climate Choices</i> by the National Research Council of the National Academies	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
<i>Assessment Reports</i> by the Intergovernmental Panel on Climate Change (IPCC)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅

21. How much have you relied on the following websites to aid your decisions about how to respond to the impacts of a changing climate?

	Not at all	A little	A moderate amount	A lot	Don't know this source
National Drought Mitigation Center's US Drought Monitor (drought.unl.edu)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
National Integrated Drought Information System's (NIDIS) US Drought Portal (drought.gov)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
NOAA's Climate Services Portal	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅

(Climate.gov)					
NOAA's National Climatic Data Center (NCDC) (ncdc.noaa.gov)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
US Global Change Research Program (globalchange.gov)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
USGS National Climate Effects Network (gcp.usgs.gov)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
State of Hawaii Commission on Water Resource Management (state.hi.us/dlnr/cwrm/)					
Pacific Regional Integrated Sciences and Assessments (Pacific RISA) (PacificRISA.org)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
Pacific Climate Information System (PaCIS) (noaaclimatepacis.org)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
Center for Island Climate Adaptation Policy and Planning (ICAP) (islandclimate.edu)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅

22. What type of information would be useful in supporting the decisions you or your agency/organization makes?

	Not at all useful	A little useful	Moderately useful	Very useful
Location-specific vulnerability assessment (i.e., assessing the water resource's and water users' exposure, sensitivity, and capacity to adapt to climate change)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
Location-specific climate change projections (temperature, precipitation, etc) for the short term (from now to 10 years in the future)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
Location-specific climate-change projections (temperature, precipitation, etc) for the medium or long term (more than 10 years in the future)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
Weather or seasonal forecasts	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
More reliable forecasting of El Niño events and any changes in the frequency or severity of such events under climate change	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
Implications of climate change for runoff, pollutant loads, salinity, and water supply	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
Cost projections of water rates in various climate scenarios.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄

23. The science of climate change and the impacts on fresh water resources is evolving. As scientists learn more, their ability to project changes and to anticipate impacts will improve over time. For now, however, the information available tends to be somewhat uncertain. Please tell us how much you agree with the following statements on how uncertainty affects your ability to use climate information.

	Strongly disagree	Disagree	Agree	Strongly agree
When making decisions about the use of fresh water, I will only use information that has a high degree of certainty (>90% certain)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
I rely on worst-case scenarios when making decisions under conditions of uncertainty	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
If information is uncertain, I postpone decisions about the use of fresh water	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
When information is uncertain, I rely on other experts to make decisions for me	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
When information is uncertain, I examine a range of plausible projections to assess the robustness of my decision				

24. To what extent do the following factors prevent you from using available climate information ?

	Strongly Disagree	Disagree	Agree	Strongly Agree
Available climate information is not relevant to decisions and planning that occur within my agency or organization	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
Don't know what information I need	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
Unable to find the information	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
Insufficient expertise within my agency or organization	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
Insufficient staff time	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
Lack of funding	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
No legal mandate or lack of a clear mandate	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
Lack of perceived importance within my agency or organization	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
Lack of perceived solutions within my agency or organization	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
Lack of public awareness/demand	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄

Lack of technical assistance from government	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
Lack of social acceptability	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
Science is too uncertain	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
Opposition from stakeholder groups	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄

Section 6: Planning and Preparedness

25. Some people say that we should prepare for the impacts of climate variability change on the availability and quality of fresh water resources. Please tell us how much you agree with each of the following statements about what should be done.

	Strongly Disagree	Disagree	Agree	Strongly Agree
Build more reservoirs	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
Increase water rates so that people use less water	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
Give companies tax breaks if they use alternative sources of water (e.g., reclaimed waste water)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
Impose water restrictions during drought	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
Improve policy (such as revisions or additions to existing codes, laws, and/or plans)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
Improve watershed management	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
Increase public education about water conservation	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄

26. Do you think the following should be doing more or less to address the potential impacts of climate change on the availability and quality of fresh water resources from the Central O‘ahu Watershed?

	Should do much less	Should do less	Doing the right amount	Should do more	Should do much more
Corporations & business	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
Hawai‘i residents	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
US Congress	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
Hawai‘i State Legislators	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅

Hawai'i Governor Neil Abercrombie	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
Hawai'i state government officials	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
Hawai'i county government officials	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
Other (please specify _____ _____)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅

27. What, if anything, has your organization done to date to prepare for the impacts of climate change?

	Already done	Planning to begin this year	Planning to begin within 5 years	Don't plan on doing so	Not applicable
Informed myself of potential climate-change impacts	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
Informed my superiors of potential climate-change impacts	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
Conducted detailed problem assessment	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
Explored adaptation options	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
Implemented adaptation strategy	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
Evaluated effectiveness of adaptation strategy	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅

28. How do you prioritize water uses? Please rank the following water uses according to the priority they should be given for water supply. Order them from 1 (highest priority) to 12 (lowest priority). Please provide reasons for your rankings, if possible.

	Rank 1=highest priority, 12=lowest priority	Reasons
Domestic (residential & non-residential)		
Industrial (e.g., power plants)		
Agriculture		
Military		
Urban/landscape irrigation (e.g., parks, golf courses, landscaping)		
Instream flow for aquatic		

species		
Freshwater flow to fishponds or estuaries		
Recreational (e.g., fishing, swimming)		
Tourism		
Municipal		
Traditional cultural activities (e.g., taro cultivation)		
Other (please specify _____)		

29. What are the most important considerations that drive your decisions about the management of fresh water resources? Order them from 1 (highest priority) to 10 (lowest priority). Please provide reasons for your rankings, if possible.

	Rank 1=most important, 10= least important	Reason
Legal guidelines, laws, policies, codes		
Planning/development needs		
Climate change science		
Other economic pressures or constraints (describe)		
Available technological options		
Stakeholders/interest groups		
Agency mission		
My job description		
My personal environmental concerns		
Other (please specify _____)		

Section 7: Your Work and Other Personal Information

We would like to collect some background information. This information is for analytic purposes only.

30. What is your name? _____

31. What is your profession? _____

32. How many years have you been working in this profession? _____ years

33. What organization do you work for? _____

34. How many years have you held your current position in this organization? _____ years

35. What is your age? _____ years

36. Are you male or female? Male 1
 Female 2

37. How long have you been a resident of Hawai'i? _____ years

38. What is the highest level of education that you have completed?

- High school or less 1
- Some college or 2-year degree 2
- 4-year college graduate 3
- More than 4-year college degree 4

39. What is your current income range?

- Less than \$10,000 1
- \$10,000 - \$49,999 2
- \$50,000 - \$79,999 3
- \$80,000 or more 4

40. How would you describe your race or ethnicity? (*Check all categories that apply*)

- Hispanic or Latino..... 1
- Alaskan Native..... 2
- American Indian..... 3
- Black/African American 4
- Native Hawaiian..... 5
- Guamanian 6
- Samoan..... 7
- Other Pacific Islander 8 SPECIFY: _____

- Asian Indian 9
- Chinese..... 10
- Filipino..... 11
- Korean..... 12
- Vietnamese..... 13
- Japanese 14
- Other Asian 15 SPECIFY: _____
- White/Caucasian 16
- Some Other Race 17 SPECIFY: _____
- Don't Know 97

41. If you selected multiple categories above in Question 13, which one of these groups do you most strongly identify with?

Race/Ethnicity Number: _____

Don't Know 97

42. Are you interested in receiving a copy of the results of this survey?

₁ Yes (please provide email or mailing address: _____)

₂ No

Thank you for participating in this research.